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Validation of information-seeking behaviour of nursing students confirms most profiles but also indicates desirable changes for information literacy support

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Validation of information seeking behaviour of nursing students confirms most profiles but also indicates desirable changes for information literacy support

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Validation of Profiling information seeking behaviour of nursing students confirms most profiles but also indicates desirable changes for : revisiting the validation of information seeking behaviour profiles and gaps in information literacy support

Abstract

Purpose. The study ~~had two purposes~~aims were: 1) to replicate a and validate a previous study by the first author to confirm previous findings (internal validity) and to check construct validity of previously proposed on the development of information behaviour profiles profiles of undergraduate nursing students; and 2) to compare the information processes used by students in parallel with requirements of early professional practice.

Design/methodology/approach. The replication study used the same questionnaire, ~~but in an online format~~delivered online, to all 175 students across three years of a BSc Adult Nursing degree programme on one UK university ~~campus of a UK university~~. The survey included questions on information seeking processes, personality, approaches to learning and self-efficacy with information literacy. The literature review examined evidence around the transition from nursing student to practitioner, and the Association for College & Research Libraries (ACRL) standards for nursing information literacy.

Findings. The response rate was 86/175 (49%). Result verified findings on the most frequent information processes and association between approach to learning and information literacy self-efficacy. The personality findings differed. Combining results for both studies helped confirm most of the information behaviour profiles. Mapping the frequent information processes against requirements of practice indicated gaps, particularly around professional networking.

Originality. Validated a set of information behaviour profiles for nursing students and linked these to the requirements of professional practice.

Research limitations/implications. ~~As both~~The lower response rate (replication) widened confidence intervals. Both studies were carried out at

one higher education campus, further research to assess external validity is required.

Practical implications. Information behaviour profiles, plus the mapping, ~~helps should help~~ librarians and tutors develop tailored information literacy support that is clinically relevant, and supports transition to practice.

1 Introduction

Information literacy for nursing undergraduate students should be guided by the demands of future professional practice. In the UK, the Nursing and Midwifery Council (NMC) (2018, p.9) states that nurses must “always practise in line with the best available evidence...and make sure that any information or advice given is evidence-based”. A systematic review of the pedagogical strategies used in the teaching of evidence-based practice in nursing (Aglen, 2016) points out the need for students to learn professional discretion in solving ill-structured problems, to develop their critical thinking and elaborate on existing knowledge to be able to transfer this to different situations – crossing the theory-practice divide. Although the review found that information literacy was often considered the core competence for evidence-based practice, knowledge about how evidence relates to practice is probably the most important prerequisite. The NMC (NMC, 2010, p.23) advocates that nursing practice should be informed by research but background surveys for a Council of Health Deans report (McCormack *et al.*, 2019) on research confidence confirm problems noted by Darbyshire *et al.*, (2019) on lack of skills among graduates to research and question practice. More attention to the processes of information seeking, appraisal and use might help in designing information literacy programmes that help nursing students in their training as well as in the transition from student to practitioner. Information literacy has been defined variously but is generally considered to be “the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning.” (ACRL, 2016). This definition clearly contains the element of information seeking behaviour alongside knowledge of what to do

[with the information once found. On closer inspection the relationship between information literacy and information seeking suggests that these two concepts overlap. Information seeking and the associated behaviour related to this can be defined as “what takes place when an individual \(or group\) identifies an information gap and purposefully tries to fill it” \(Anon 2, date, p.x\). This suggests information seeking behaviour is not only an element within the broader term of information literacy \(in terms of actively looking for information\), but that it also extends outside information literacy by including how and why information is sought \(Julien and Williamson, 2011\).](#)

Previous research developed a set of profiles of information behaviour of nursing students (Anon 1, date). These profiles are based on a set of information seeking processes, personality characteristics, approaches to learning and information literacy self-efficacy. This paper describes the replication of the original study (Anon 2, date), subsequent validation of the profiles proposed by Anon 1 (date) and discusses implications for librarians designing information literacy programmes for nursing students to better prepare them for practice.

The literature review provides an overview on the transition from nursing student to nursing practitioner, relevant studies on information behaviour, information seeking processes, the impact of personality and learning style on information seeking behaviour, and what self-efficacy means for information behaviour. Next, the replication methods are described. The results are presented, compared with the previous study, and combined as necessary. The proposed amended profiles are discussed, with emphasis on whether these profiles fit the needs of students as they transition to practice.

2 Literature review

2.1 Transition from nursing student to practitioner

Woods *et al.* (2015) found that final year Australian student nurses felt prepared for practice, however, they worried about managing a large patient caseload, and how time constraints might affect clinical practice. Similarly,

Diekema *et al.* (2019) surveyed a group of recent US nursing graduates to find out how nursing education and information literacy instruction could be improved to help newly graduated nurses in practice. Findings showed that in the workplace the new nurses asked nursing colleagues, and often needed help in evaluating resources that are generally available, rather than databases available only to students.

Graf *et al.* (2020) reviewed theories relevant to nurses' transition from student to practitioner and concluded that Duchscher's stages of transition theory (which blends previous theories) fitted with the experiences of nursing students coming into practice. The four psychosocial elements of the theory are emotional (implications of support, or lack of it), physical (coping with the workload), socio-cultural (becoming part of the team, trusting their own judgement) and intellectual (the ability to recall theory to match a clinical situation). More relevant findings are provided from a systematic literature review on newly graduated nurses' orientation experiences notes the feeling of increasing competence and confidence alongside positive and negative experiences of working with colleagues (Pasila *et al.*, 2017). In comparison, Hunter and Cook (2018) in a small qualitative study based in New Zealand, explain how newly graduated nurses realise that nursing is not primarily about one-to-one patient care, but more about nursing teamwork, learning from others, and from experiences with good and bad role models.

Voldbjerg *et al.* (2016), in a meta-ethnographic study of the use of knowledge sources by newly graduated nurses, distinguishes the phases of doing and following from the later (after around six months) of knowing and doing. Ideally, the practice environment should nurture critical thinking and questioning, to allow new graduates to learn how to use multiple knowledge sources (external evidence, internal experts). At first (doing and following phase) use of colleagues as knowledge sources may be uncritical as the basics of the principles of lifelong learning are internalized, but later, during the knowing and doing period, nurses should reflect more, becoming more aware of the patient and family as knowledge sources. In a supportive professional environment, the authors suggest that newly graduated nurses

may themselves be a resource for evidence-based practice by asking questions about practice.

Several themes of importance to librarians designing information literacy programmes emerge from the above studies and reviews. Newly graduated nurses do and should use colleagues as sources of information. This is part of professional teamwork and also part of the process of becoming a reflective practitioner. Professional judgement requires understanding how theory and evidence may be applied to a care situation, with a particular patient and family, or groups of patients with a similar set of conditions.

2.2 Use of evidence-based sources in practice

A systematic review (Alving *et al.*, 2018) of hospital nurses' information behaviour and use of information sources found that use of bibliographic databases was generally low, whereas use of search engines (Google) was high. Nurses frequently reported a lack of time, and consulting colleagues was faster and easier. However, as noted earlier, asking colleagues is part of becoming a member of the team. Asking a question is not necessarily a request for simple information. In addition, Wahoush and Banfield (2014), in a survey of registered nurses and final year students, found that registered nurses believed that their environment supported information searching (of published evidence) at least sometimes, and that nurses were frequently looking up policies and procedures. A survey of licensed practical nurses in Canada (Wadson and Phillips, 2018) found that desired skills included developing lifelong learning skills and using information collaboratively.

2.3 Information literacy support for nursing

Information literacy support for undergraduate nursing education varies in content and structure, as does evidence-based practice support for nurses in the workplace (Häggman-Laitila *et al.*, 2016). Sometimes, (e.g. Kolstad, 2015), the librarian co-teaches with nursing faculty during work placement, in other settings the focus is more on finding and appraising research evidence in the classroom. Generally, there is more support (certainly from librarians) for clinically focused information literacy programmes integrated into the

curriculum, although the differences in outcomes between traditional and integrated programmes may not be substantial (Farrell *et al.*, 2013; Özbıçakçı *et al.*, 2015; McGowan, 2019). Munn and Small (2017) in a systematic review on the best way of developing information literacy and academic skills among first year health science students points out that there is poor student uptake when support programmes are not embedded. In higher education, constructive alignment theory (Biggs and Tang, 2011), suggests all systems for teaching, learning and assessing be aligned.

The ACRL (2013) information literacy competency standards for nursing represent skills required by both students and practising nurses. There are five main standards, with subcomponents and associated outcomes. Table I illustrates how these standards map to the information behaviour processes investigated in this study. The ACRL standards express what experts agree nursing students and nurses should be able to do, the column for information behaviour process describes what the users actually do, based on grounded theory of academic information seeking (Foster, 2004; Foster and Urquhart, 2012) (described in more detail in Section 2.4). The ACRL standards naturally emphasise efficient searching, but the users often encounter useful information by happy chance (chancing) and may browse less selectively than the outcomes listed in the standards imply. Standard five is not associated with any general information behaviour process observed.

(Table I about here)

The design of information literacy programmes depends on the possibilities and constraints of different settings, but some researchers are trying to incorporate the ACRL (2013) information literacy competency standards for nursing (e.g. Weng, 2016). Trying to map the ACRL framework to professional nursing standards (Willson and Angel, 2017) probably requires more development and verification.

2.4 Modelling information behaviour

~~Information seeking behaviour can be defined as “what takes place when an individual (or group) identifies an information gap and purposefully tries to fill it” (Anon 2, date, p.x).~~

Information seeking behaviour is the purposive seeking of information to satisfy a gap in knowledge (Wilson, 2000), and this is reliant on both the situation and the person performing it (Heinströem, 2005). Traditional models of information seeking behaviour tend to be stage based models (Wilson, 1981; Ellis, 1993; Kuhlthau, 1993; Wilson, 1999); although more recent integrated models do include elements of feedback and looping in a more iterative process (Godbold, 2006; Robson and Robinson, 2013; 2015). These and other integrated models have been analysed in detail elsewhere (Savolainen, 2016). Many models suggest that information seeking is a process that follows a structure (whether including iteration or not) and that certain elements in the process occur before others. An alternative model formulated by Foster (2004) from grounded theory research on a group of academics found that information seeking does not follow through phases, rather it may start and stop in the core processesstages of opening, orientation or consolidation (Foster, 2004; updated version in Foster and Urquhart, 2012) (Table II). The updated version verified the model against a large qualitative data set concerning student information behaviour, and minor changes were made. These include the choice of the term *chancing* to describe accidental serendipity for students in information seeking – this may well describe how they happened on some information they found useful when searching for another academic task. Browsing was separated into selective or open browsing. For students identifying keywords and keyword searching were almost simultaneous processes. Defining a problem for nursing students usually refers to the formulation of a research question for searching – the PICO format of Patients/population/problem, Intervention, Comparison, Outcomes (Polit and Beck, 2021).

(Table II here)

The information seeker can dip and delve, with no defined start or end point into among various stagescore processes (Opening, Orientation, Consolidation) that each have, characterised by a set of possible micro-processes (termed microprocesses in the original), and there is no defined start or end point (Foster, 2004). Foster, *et al.*, (2008) performed a code validation exercise on the original data and another data set of student information behaviour, and minor adjustments were made to the original model (Foster and Urquhart, 2012). The validation work concluded that students were more likely to blur keyword searching (opening) and identifying keywords (orientation), andand both searching and ~~(and~~ browsing) wereas generally more superficial than for academic staff. As students were often task and deadline driven, many consolidation processes, andand monitoring (opening) were less frequently conducted. Finishing is a process that applied only to academic staff, not students, and can be seen as the end of the information seeking process

Information seeking routines may change according to changes in the external environment, just as clinical practice of newly qualified nurses is changed by the need to deal with a large patient caseload independently. There are time constraints but also opportunities to learn from working with colleagues and members of a clinical team. Individuals vary in their preferred approaches to learning, personality characteristics and self-efficacy and these personal characteristics affect how users seek information (Ford, 1979, 1986; Ford, Miller and Moss, 2001; Heinströem, 2003, 2005; Hyldegard, 2009; Heinströem, *et al.*, 2014).

Approaches to learning, personality and self-efficacy are reviewed in the following sections, but we must not forget that these personal characteristics partly explain, but do not wholly predict what an individual will do in any particular information seeking situation. Dervin's sense-making methodology stresses the importance of understanding how individuals bridge the gaps, making meaning for themselves in that situation at that time (Dervin *et al.*, 2018). The situation, and the nature of the gap to be bridged, affects the strategies adopted.

2.5 Approaches to learning

Learning Approaches whilst having elements akin to Learning Styles are different in that they focus more on the methods used to study rather than the way students process information (Tsingos, *et al.*, 2015). Building on previous work by Marton and Saljo (1976) and evolving over time Entwistle and colleagues developed the Approaches to Study Skills Inventory for Students (Entwistle, 1997). This inventory contains a range of statements in relation to the way students study, with a long 64 item version for the initial standard inventory now being supplemented with shorter 30 and 18 item versions. Students self-score for each statement which leads to three categories of learning: Deep, Strategic, or Surface. Deep learning involves a high degree of motivation to find out about a topic, taking a broad view/big picture approach (Furnham, 2011). Students doing deep learning read widely using an array of different sources in order to understand a topic (Heinström, 2005). Strategic learners are motivated by getting high grades or reaching certain targets, do not read widely, but rather try and meet the needs of the assignment at hand (Furnham, 2011). They are good time managers and organise their work well (Heinström, 2005). Surface learners are only motivated by a fear of failure and are focussed on rote learning and memorisation (Furnham, 2011), and tend to put little effort into their studies (Heinström, 2005). High educational performance has been positively linked to both a Deep style (Hyytinen, Toom, and Postareff, 2018); and with a Strategic style, whereas Surface learners are often lower achievers (Heinström, *et al.*, 2014). A systematic review of the relationship between learning styles and critical thinking in nursing education (Andreou *et al.* 2014) found that there could be a link between learning styles and critical thinking, but much depends on the setting and nursing student population. A qualitative study (Chipamaunga, 2015; Chipamaunga and Prozesky, 2019) examined how health science students developed the ability to integrate learning. At first, integration is considered to be a collection of fragmented facts, but as knowledge and experience develops, links may be made and at the highest level, integration of learning happens automatically and students adopt strategies that enable learning for meaning.

2.6 Personality

According to Funder (2013, p.5) personality is “an individual’s characteristic pattern of thought, emotion and behaviour, together with the psychological mechanisms – hidden or not – behind those patterns”. The most commonly used model to investigate personality is the Five Factor model with Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism (OCEAN) the most often used terminology for describing each component (Saucier and Goldberg, 1996). Heinström (2003) describes Openness as the “depth, breadth and variability in a person’s imagination”; Conscientiousness as a measure of “goal directed behaviour and amount of control over impulses”; Extroversion as an outgoing character; Agreeableness being linked with altruism and a caring character; and Neuroticism as a measure of emotional control. High levels of Conscientiousness and Openness have positive relationships with successful learning (Duff, et al., 2004; Komarraju and Karau, 2005; Bidjerano and Dai, 2007; Prospero and Vohra-Gupta, 2007; Komarraju, et al., 2011); with Agreeableness linked to high levels of academic achievement in some studies (Komarraju, et al., 2011). Extraverts have been found to be purposeful and perform highly active searches (Halder, et al., 2010); whilst the Neurotic trait being linked to high anxiety and stress is negatively associated with many aspects of information seeking (Heinström, 2003).

2.7 Self-efficacy

Self-efficacy is an individual’s belief in their own ability to achieve a task or reach a goal through their own behaviour (Bandura, 1986). Having a skill set that can accomplish a task is not enough without a confidence to use those skills effectively (Bronstein, 2014). A person’s degree of self-efficacy also determines the amount of effort they are prepared to invest in a task (Bronstein, 2014). Self-efficacy is situation specific and determines the perceived capability of an individual to achieve an outcome. Self-efficacy differs from Rotter’s (1954) social learning theory which focuses on a person’s internal and external locus of control which includes elements outside of the control of the individual. Self-efficacy has variously been linked with academic

achievement (Braten, *et al.*, 2004; Usher and Pajares, 2006; Sins, *et al.*, 2008, Wang, *et al.*, 2008; Aharony and Gur, 2019) and specifically for nursing students by McLaughlin, *et al.* (2008). High levels of self-efficacy are also linked to high computer information literacy (Hatlevik, *et al.*, 2018); and a study by Jungert and Rosander (2010) discovered that students studying courses with elements of problem based learning had higher levels of self-efficacy linked to their ability to complete the course suggesting that this type of learning may enhance self-efficacy.

The personality trait of openness has been linked with a deep learning style; whereas conscientiousness whilst linked with deep learning is also linked to a strategic learning style (Furnham, 2011; Anon 1,2, date and date; Heinström, *et al.*, 2014). Furthermore, deep learning centres on exploration and browsing, rather than structure, in information seeking (Heinström, *et al.*, 2014); and is also associated with high levels of self-efficacy with information literacy (Anon, 1,2, date and date; Aharony and Gur, 2017). High levels of extraversion are associated with networking with fellow students and tutors and this is linked to both the deep and surface learning styles (Heinström, 2005; Anon, 1,2, date; date).

Mi and Riley-Doucet (2016) examined health professional students' lifelong learning orientation and possible associations with information skills and self-efficacy. The sample included 325 medical and 850 nursing students, and responses were obtained from 209 undergraduate nursing and 82 graduate nursing students. The analysis used the Jefferson scale of lifelong learning and an information self-efficacy scale developed by one of the authors. There was a correlation between the Jefferson lifelong learning scale and the information self-efficacy scores, and undergraduate nursing students scored lower than the postgraduate nursing students. The authors note that the students were sometimes more confident in their skills than their performance in two test questions warranted, and the authors recommend that students be encouraged to reflect more on their searching in information literacy programmes.

Few studies have examined all three factors (personality, approaches to learning, and self-efficacy with information literacy) in relation to information seeking behaviour. One such study (Anon 1,2, date; date) investigated whether it was possible to create information ~~seeking~~ behaviour profiles for a group of nursing students with the aim of tailoring information skills sessions to their preferred ways of searching and gathering information. The research utilised Foster's (2004) non-linear model of information seeking along with self report scales on approaches to learning (Entwistle, 1997), personality (Saucier, 1994), and self-efficacy with information literacy (Kurbanoğlu, *et al.*, 2006) to form a questionnaire. Seven distinct profiles were generated from this study: Deep investigator, Deep adventurer, Deep identifier, Strategic all rounder, Strategic collector, Surface co-ordinator, and Surface skimmer. All of the profiles combined an approach to studying (Deep, Strategic, Surface), a personality type (Extraversion, Agreeableness, Conscientiousness, Emotional Stability, Openness), with a high or low level of self-efficacy with information literacy. This combination of traits was further linked to elements of information ~~seeking strategies~~ processes (e.g. chaining, browsing, networking, picture building, etc) to complete the provisional profiles.

2.7 Aims and objectives

One aim of this current study was to replicate the quantitative aspect of the original research to determine which (if any) of the original relationships ~~exist~~ are retained (see Figure I) and thus the construct validity of the profiles. It replicated as ~~much far~~ as possible the methods used ~~in the original study~~ originally (Anon 2, date) to enable comparable data.

There are often disappointing rates of replication in psychology research (see Society for the Improvement of Psychological Science <https://improvingpsych.org>). Fabrigar, Wegener and Petty (2020) discuss replication problems in terms of the classic framework of four forms of validity (Cook and Campbell, 1979). Often studies have low statistical power leading to Type I errors (concluding that there is a relationship when none exists) – a statistical conclusion validity problem. Questionable research practices (for example, in sampling) may also lead to Type 1 problems. In nonexperimental

studies, i.e. non-randomised research study designs (common in library and information science) internal validity problems are almost inevitable. In this study construct validity concerns the way in which the variables (information seeking processes, personality, information literacy self-efficacy, and approaches to learning) were mapped to derive information seeking profiles. The replication problem of external validity, the extent to which the original study results can be generalized to other settings, was minimised by performing the study in the same institution, albeit at a different time and with changes to the way the questionnaire was distributed.

Research questions (see Figure I)

1. What is the impact of different approaches to learning, personality traits, and self-efficacy levels on information seeking and use behaviour?
2. Do the results of the study validate the provisional profiles of the original study?
3. What do the findings imply for information literacy programmes for nursing students to prepare them for practice?

3 Methods

3.1 Ethical approval

The research was granted ethical approval by the Faculty of Health Education and Social Care DREP (Department Research Ethics Committee) at Anglia Ruskin University.

3.2 Sample

Participants in the study were nursing students enrolled on the three year undergraduate BSc Adult Nursing course at one campus of a University in the UK. All students across the three year programme (n=175) were approached in class by the researchers during September and October 2018 and provided with a participant information sheet detailing the study. Approximately a week later (after a period of reflection) all students were sent a link to the online

questionnaire. Reminders were sent monthly (the last reminder on the final day the survey was open) by email to increase the response rate.

3.3 Questionnaire design

This study utilised an online questionnaire in a cross-sectional survey design (author) In this design the data is collected at one point in time or interval of time (Wagner and Gillespie, 2019).

The questionnaire had identical questions to those used in the previous study to ensure comparable data, the only difference being that the original study used a paper questionnaire and the current study used an online version. The questionnaire was formed of four sections: information seeking (based on Foster, 2004), approaches to learning (the short 18 item version of the Approaches and Study Skills Inventory for Students (ASSIST) (Entwistle, 1997)), self-efficacy with information literacy (the 17 point Information Literacy Self-efficacy Scale (ILSES), (Kurbanoglu, *et al.*, 2006) and personality (the 40 item Mini-Markers scale) (Saucier, 1994).

Statistical analysis was via Chi-square tests, Odds Ratios, and Binomial Logistic Regression as in the original study to enable a close comparison of data.

4 Results

4.1 Response rate

A total of 90 students responded although 4 surveys were incomplete and not used in the final analysis. This left 86 fully completed surveys (response rate of 49%). In comparison the original survey reached a 74% response rate.

With online questionnaires the low response rates can lead to threats to internal validity, hence we combined the results to avoid sampling bias, after checking that most relationships were partially or wholly confirmed. For the combined results (original and replication) the response rate was 64.2%. For the combined results, the estimated confidence interval for the percentages quoted in the results tables is $\pm 3.5\%$.

4.2 Information literacy self-efficacy and approach to learning

Of the 86 respondents, 44 had a high level of information literacy self-efficacy and 42 had an intermediate level. For approaches to learning, 32 were Deep, 29 Strategic, 16 Surface and nine had a mixed style. A chi-square analysis of this relationship was significant (chi value 15.025, 3 degrees of freedom, $p=0.002$) indicating that Strategic learners were more likely to have advanced self-efficacy and Surface learners more likely to be at the intermediate level (Table III).
(Table III about here)

This finding is comparable to the previous study, although the difference in ratio between Intermediate and Advanced IL-SE for Deep learners was more pronounced in the previous study, and conversely, this ratio was less pronounced for Surface learners in the previous study.

As some of the sub-groups were small, the samples for the original and replication study were combined to assess which differences remained significant (Table IV). A chi-square test showed that there was an association between level of information literacy self-efficacy and approach to learning (chi value 17.04, 3 degrees of freedom, $p=0.001$) Inspection of the table indicated, however, that the deep and strategic rows were very similar in proportion (there were about twice as many deep or strategic learners in the advanced information literacy self-efficacy group as there were in the corresponding intermediate group). By contrast, those who showed a mixed approach to learning were equally split between the two groups for information literacy self-efficacy. Surface learners were about twice as likely to be in the intermediate literacy self-efficacy group than the advanced group.

(Table IV about here)

4.3 Personality and approach to learning

The relationship between personality and approaches to learning showed that Deep learners were the most Agreeable, Surface learners the most Extravert, and Strategic learners the most Conscientious, Emotionally Stable, and the most Open (Table III). This finding was similar to the previous study when Surface learners were again the most Extravert, and Strategic learners were the most Conscientious (indicating a deliberate or organized way of searching) and Emotionally Stable. The difference between the studies being that Deep learners were previously the most Open and Strategic learners were the most Agreeable. In the cases where differences were found the size of the difference was very small. Surface learners were again the least Conscientious, Agreeable and Open suggesting less inclination to work diligently and flexibly.

For self-efficacy with information literacy, participants with an Advanced level were more Extravert, Agreeable, Conscientious, Emotionally Stable, and Open (Table V). This mirrored the results from the previous study.

(Table V about here)

4.4 Information processes

The results for number of students agreeing use of particular ~~micro-~~processesinformation processes for information seeking and use showed close similarity to the previous study. The top five ranked ~~micro-~~processes are the same (although in a slightly different order), and the two lowest ranked ~~micro-~~processes are also the same (again in a different order) (Table VI. The combined results indicate very little difference among the first four ~~micro-~~processes.

(Table VI about here)

No ~~micro-~~process is ranked more than four places differently between the original and replication study. For the combined results, the main Opening

~~micro~~-processes conducted were Chancing, Keyword searching, Collecting, Browsing, and Chaining. Orientation mostly comprised Defining a problem and Identifying keywords. Consolidation mostly comprised Reviewing, Incorporating, Verifying, Sifting and Knowing Enough.

4.6 Analysis of relationships

Odds ratios were performed to investigate any relationships between information seeking and both self-efficacy with information literacy and Approaches to Learning (Table VII). In the replication study, Deep and Strategic learners used similar ~~micro~~-processes within the Opening phase of information seeking, with Surface learners appearing to be completely different types of searchers. As might be expected, Deep learners were more likely to be Exploring Breadth, and Strategic learners used Chaining (checking reference lists). Strategic learners are also more likely to decide when the search was complete (Knowing Enough), to define boundaries (Refining), and to determine relevancy during a search (Sifting). Between the two studies, there were some similarities and minor differences. The combined results illustrate the similarities between students with deep and strategic approaches to learning and difference between those two groups and the students with a surface approach to learning.

For self-efficacy with information literacy, all the ~~micro~~-processes more likely performed by those with the Advanced level in the previous study were again performed by this group in the current study (Keyword searching, Chaining, Defining a problem, Identifying keywords, Knowing enough, Refining, and Sifting). In the current study however, the Advanced group were also more likely to perform Collecting, Browsing, and Verifying. Results for the Intermediate group (more likely to perform Networking) were different from the previous study, when the Intermediate group were more likely to perform Monitoring and Identifying sources. The combined results (in terms of frequency) suggest that the difference between the intermediate and advanced self-efficacy with information literacy is probably more that of degree, rather than the groups carrying out characteristically different information processes. In contrast, the preferences for different information

processes may be more distinct between the surface learning group and the other two groups (deep and strategic approaches).

(Table VII about here)

Personality showed the greatest degree of difference between the two studies. Both studies showed no significant positive relationships between Extraversion and any [information micro](#)-process; and no significant negative relationships between Emotional Stability and Openness and any [information micro](#)-process. But there the similarities end. None of the positive or negative relationships between personality and the information seeking [micro](#)-processes were the same in both studies. Whereas previously there were positive relationships between Agreeableness and Reviewing; Conscientiousness with Sifting and Verifying; and Openness with Browsing; and negative relationships between Agreeableness and Picture building and Identifying sources - in the current study both the positive and negative relationships are different (see Table VIII).

(Table VIII around here)

Here Agreeableness, Conscientiousness and Openness are now positively linked with a range of [information micro](#)-processes, and Emotional Stability is linked with Picture building. Extraversion is negatively linked with Incorporating and Conscientiousness is negatively linked with Networking and Picture building.

4.7 Verification of profiles

The original profiles were developed by piecing together the processes that were linked to particular personality traits and characteristics (level of confidence with information literacy). In view of the differences between the original and replication study, over personality links in particular, the combined results were used to avoid problems that could be associated with the wider confidence intervals for the replication study (with lower response rate). The final set of profiles is therefore a set of six profiles based on the merged data

rather than the original seven profiles. Many of the profiles retain the same name, but with some minor changes to the profile. The Deep Identifier and Deep Investigator profiles have been replaced by the Deep Explorer profile. The Strategic Detector profile has been added and the Surface Skimmer profile deleted (Table IX).

Take in Table IX around here

5 Discussion

Replicating the original research study enabled similarities and differences to be identified and investigated. It also provided the opportunity to combine data creating a larger pool of participants for validation of some of the findings. In this new study, the results confirmed many of the original findings and associations. The five most highly ranked information ~~micro~~processes conducted were, as previously:

- Defining a problem (Orientation)
- Identifying keywords (Orientation)
- Chancing (Opening)
- Reviewing (Consolidation)
- Keyword searching (Opening)

For the respondents as a group, the main Opening ~~micro-processes~~processes conducted were Chancing, Keyword searching, Browsing, Chaining and Collecting. Orientation mostly comprised Defining a problem and Identifying keywords. Consolidation mostly comprised Reviewing, Verifying and Sifting. All of which suggests nursing students generally are still finding and manipulating information in a similar manner despite the increase in use of electronic information resources and mobile devices. The ~~information process~~ ~~micro-process~~ Knowing enough had the biggest change dropping four places

in the new study, possibly related to perceptions of the amount of electronic information available. Interestingly, more students are now checking for accuracy (Identifying sources) and relevancy (Verifying), possibly more aware of the unreliability of much of this information that may not be peer-reviewed or independently checked for accuracy.-

The link between high levels of self-efficacy with information literacy and the Strategic and Deep approaches to learning was confirmed, and several of the elements of information seeking were again linked with different approaches to learning and personality (e.g. Exploring breadth with Deep learners, Networking with Surface learners). ~~All of which suggests nursing students generally are still finding and manipulating information in a similar manner despite the increase in use of electronic information resources and mobile devices.~~ One finding noted in the original study and confirmed in the replication was the presence of mixed approaches to learning. This is not unusual among nursing students: Fleming *et al.* (2011) refer to dual learning and the lack of a dominant learning style in a longitudinal study, Rassool and Rawaf (2008) refer to a dual learning styles group, and Zhao *et al.* (2018) suggests that students may choose different styles depending on the type of assessment. In general, the deep versus surface dichotomy may disguise how and why students actually study (Godor, 2016).

From the literature review dealing with the characteristics of the transition from student to practitioner, networking in the sense of knowing when and how to use professional colleagues, was an important skill (Hunter and Cook, 2018; Pasila *et al.*, 2017; Voldbjerg *et al.*, 2016; Woods *et al.*, 2015), and is reflected in the ACRL standards (2013) (Standards 1.2, 1.3, and 3.5, for example). Professional judgement requires understanding how theory and evidence may be applied to a care situation (Graf *et al.*, 2020) and can be described by the information process of incorporating, or as the type of outcomes detailed in the ACRL standard 3.4. Networking as an information process is conducted by surface learners in both the original and replication study but only the original study found that networking was also frequently conducted by some deep learners. Given the importance of effective networking in professional practice, there seems a gap here between

requirements and need for professional networking (as reflected in the ACRL standard, and the nursing literature) and the information processes acknowledged by students. There is a difference between networking in the sense of asking peers (other students) for advice and networking in the sense of communicating effectively with colleagues. The students with a surface approach to learning, and a preference for networking may in some ways be better prepared for a transition to practice than those with a strategic or deep approach to learning, but those with a deep or strategic approach to learning may be better prepared for integration of learning (Chipamaunga, 2015). For the methodology used here, the questionnaire section on information processes used may need to differentiate better between the complexities of professional networking and asking other students for advice.

There are some indications that subjective estimations of information literacy self-efficacy by the nursing student respondents may be unreliable, as noted by Mi and Riley-Doucet (2016). Table IV4 for the combined data from the original and replication study indicates that both deep and strategic learners were twice as likely to profess advanced self-efficacy with information literacy, in comparison to the surface learners where intermediate levels of self-efficacy with information literacy were twice as common as advanced levels. The proportion of respondents showing a mixed/allrounder learning approach perhaps indicates more fluidity in the approaches to learning demonstrated by the nursing students in this sample, compared to other studies that examined students from a range of disciplines (e.g. Heinström, 2005). It is possible that the deep learners view perceived competence in information literacy as effective information literacy, and the strategic learners are more concerned with efficient searching and digital competence, but this would require more investigation. The reasons for intermediate self-efficacy in information literacy and its association with a surface approach to learning also need more investigation, as the preferences for a surface approach may reflect a more visual or social approach to information processing. Sanderson (2011) warns of the dangers of equating the deep approach to learning with “good” learning.

There were several differences between this study and the previous one, with Personality showing only minor correlations. This could be a small sample effect, or, equally, that personality is not a major influence on the way nursing students cope with learning tasks. If there are many different types of learning tasks and placements during their undergraduate education, then the usual links between openness and deep learning, conscientiousness and strategic learning, (Furnham, 2011) and agreeableness, or conscientiousness and high levels of academic achievement (e.g. Komarraju, *et al.*, 2011), may be less distinct than they might be for other disciplines where the expectations are more focused and consistent.

For librarians and tutors designing information literacy programmes for nursing students, preparation for the transition from student to practitioner probably requires more focus on information processes that are likely to be involved in critical thinking, reflection and professional networking. Information processes can be mapped to the ACRL (2013) standards (Table 4), although some of the processes actually practised are not as focused as the ACRL standards might deem desirable. Browsing by students may be more selective and less thorough, and Chancing is probably a more haphazard process of encountering useful information but one that reflects how bits of learning are slowly pieced together – integrative learning (Chipamaunga, 2015). That slow and zig-zag process of learning also seems to fit with the observation that processes associated with the core process of Consolidation (e.g. Incorporating, Verifying, Knowing enough) are less frequent than Opening processes such as Keyword searching and Chancing. On the plus side, the students seem generally competent in Defining a problem (Orientation) although students with a surface approach to learning may need more practice. Defining a problem in clinical practice may also be more complicated than defining a problem in terms of a database search.

The final verified profiles may be viewed as common sets of behaviour, aptitudes and attitudes, some valuable for academic progress, some valuable for future professional practice. Table X considers how the profiles fit generally accepted ideas around good academic skills and progress, and also

suggests where there may be gaps in assisting the transition to practice for nursing students.

(Table X here)

6 Limitations

Both the original and replication study were conducted within one institution, which may limit the transferability of the findings as the undergraduate nursing curriculum changes over time (as had happened here) and may vary from one institution to another within a country as well as between countries. The replication study had a lower response rate than the original study which meant that confidence intervals were much wider than desirable. The estimation of information literacy self-efficacy was based on subjective estimates by participants, and ideally should be verified by more objective testing or examples of performance in a range of information related competences.

7 Conclusion

These combinations of characteristics seem to be "information behaviour habits" that are adopted in response to educational challenges. The replication study ~~made verified and made~~ minor amendments to the information seeking behaviour profiles associated with various combinations of approaches to learning, personality, information processes and self-efficacy with information literacy that nursing students demonstrated in the original study. Nursing students demonstrated different approaches to learning, and these learning approaches may change according to need and how learning is integrated. ~~There are~~The study confirmed interactions among approaches to learning, information literacy self-efficacy, personality ~~(possibly~~(to a lesser extent) and processes adopted in information seeking and use. Rather than basing information skills/information literacy sessions on assumptions of what students should do, using the profiles would enable librarians to tailor instruction on searching skills to individuals or small groups, using appropriate

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3 tasks that provide relevant challenges. The findings also indicate that for
4 these students at least, there may be a critical gap between professed
5 behaviour patterns and the requirements of professional practice; and given
6 the retention problem for nurses, academic librarians and tutors might wish to
7 assess whether the information behaviour profiles of their students follow this
8 pattern or not. ~~in preparing them for practice in competences around~~
9 ~~professional networking and being able to use evidence when working within~~
10 ~~a clinical team.~~ Professional networking does appear to be an important part of
11 transition to practice.
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Table I. ACRL standards mapped to information behaviour processes

Standard	Relevant Component	Information behaviour process (Foster and Urquhart, 2012)
Standard one: The information literate nurse determines the nature and extent of the information needed	1.1c forms a focused question 1.1d develops a hypothesis or thesis statement and formulates questions based on the information need	Defining a problem
	1.2 Identifies a variety of types and formats of potential sources of information	Identifying sources
	1.2d Considers experts or other researchers as potential information resources	Networking
	1.2i Follows citations and cited references to identify additional pertinent articles	Chaining
	1.3 Has a working knowledge of the literature in nursing related fields and how it is produced	Chancing (<i>in the sense that accidental serendipity requires growing awareness of the links to be made</i>)
	1.4 Considers the costs and benefits of acquiring the needed information	Browsing (semi-selective)
	1.5 Re-evaluates the nature and extent of information need	Reviewing
Standard two: The information literate nurse accesses needed information effectively and efficiently	2.1 Selects the most appropriate investigative methods of information retrieval systems for accessing the needed information	Browsing (<i>preparation for selective browsing</i>)
	2.2b Identifies keywords, synonyms and related terms for the information needed 2.2e Constructs a search strategy using appropriate commands for the information retrieval system selected	Identifying keywords Keyword searching
	2.3 Retrieves information online or in person using a variety of methods	Exploring breadth (<i>selective searching</i>)
	2.4 Refines the search strategy if necessary	Refining
	2.5 Extracts, records and manages the information and its sources	Collecting
	3.1 Summarized the main ideas to be extracted from the information obtained	Knowing enough

decides whether or not to modify the initial query and/or seek additional sources and whether to develop a new research process		
	3.2 Selects information by articulating and applying criteria for evaluating both the information and its sources	Sifting
	3.3 Synthesises main ideas to construct new concepts	Picture building
	3.4 Compares new knowledge with prior knowledge to determine the value added, contradictions, or other unique characteristics of the information	Incorporating
	3.5 Validates understanding and interpretation	Verifying Networking
Standard four: The information literate nurse, individually or as a member of a group, uses information effectively to accomplish a specific purpose	4.1 Applies new and prior information to the planning and creation of a particular product 4.2 Revises the development process for the product	Monitoring
	4.3 Communicates the product effectively to others	Networking
Standard five: The information literate nurse understands many of the economic, legal and social issues surrounding the use of information and accesses and uses information ethically and legally		

Table II. Information seeking processes of Foster’s model (2012 version)

Opening	Orientation	Consolidation
Exploring breadth	Defining a problem	Knowing enough
Collecting	Picture building	Refining
Networking	Identifying keywords	Sifting
Keyword searching	Identifying sources	Incorporating
Browsing		Verifying
Monitoring		Reviewing
Chaining		<i>Finishing</i>
Chancing		

Table III. Relationship between participants’ self-efficacy with information literacy and approaches to learning

		Information literacy self-efficacy		Total
		Intermediate	Advanced	
Approach to Learning	Deep	15 (11)*	17 (38)*	32 (49)*
	Strategic	8 (27)*	21 (49)*	29 (76)*
	Surface	14 (15)*	2 (13)*	16 (28)*
	Mix	5 (18)*	4 (23)*	9 (41)*
Total		42 (61)*	44 (123)*	86 (194)*
Notes: * refers to original study figures, combining beginner and intermediate self-efficacy figures				

Table IV. Relationship between participants' self-efficacy with information literacy and approaches to learning (combined results, original and replication)

		Information literacy self-efficacy		Total
		Intermediate	Advanced	
Approach to Learning	Deep	26	55	81
	Strategic	35	70	105
	Surface	29	15	44
	Mix	23	27	50
Total		113	167	280

Table V. Relationships between personality and approaches to learning, self-efficacy with information literacy

Approach to Learning	Mean personality score				
	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
Deep	1.0156	2.7266	1.5703	-1.4023	3.9492
Strategic	1.0357	2.6652	2.6518	-1.0536	4.0536
Surface	1.6797	1.6875	0.5078	-1.7109	3.0391
Self-Efficacy	Mean personality score				
	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
Intermediate	1.1190	2.1339	1.2887	-1.5149	3.2411
Advanced	1.3068	2.6648	2.0909	-1.1705	4.0313

Table VI. Students agreeing use of the information process

Rank replication study	Information seeking process agreed	Number	Percent	Difference in rank replication vs. original	Combined results rank	Percent (95% confidence interval \pm 3.5%).
1	Defining a problem	72	84	+3	1	86
2	Identifying keywords	69	80	=	2=	85
3=	Chancing	68	79	-2	2=	85
3=	Reviewing	68	79	-1	2=	85
5	Keyword searching	65	76	=	5	79
6	Browsing	64	74	+2	7=	73
7	Chaining	61	71	=	7=	73
8	Collecting	60	70	-2	6	74
9	Verifying	57	66	+3	10	60
10	Incorporating	56	65	-1	9	67
11	Sifting	49	57	=	11	59
12	Identifying sources	42	49	+3	15	42
13	Exploring breadth	40	47	+3	16	41
14	Knowing enough	37	43	-4	12	58
15	Networking	34	40	-2	13	50
16	Refining	33	38	-2	14	47
17	Monitoring	26	30	+1	18	24
18	Picture building	23	27	-1	17	34
Notes. The 'Difference in rank' column shows how the results of the current study compare to the previous study.						

Table VII. Information processes most likely to be undertaken by students according to self-efficacy levels and approaches to learning

Approach to Learning*	Information seeking process		
	Opening	Orientation	Consolidation
Deep*	Exploring breadth Collecting Keyword searching Browsing Chancing	Defining a problem Identifying keywords	Incorporating Verifying
Deep (combined)	Chancing Browsing Keyword searching Collecting Chaining	Defining a problem Identifying keywords Reviewing	Incorporating Verifying Sifting
Strategic*	Collecting	Identifying Keywords	Knowing Enough

	Keyword Searching Browsing Chaining Chancing		Refining Sifting Reviewing
Strategic (combined)	Chancing Keyword searching Collecting Chaining Browsing	Defining a problem Identifying keywords	Reviewing Knowing enough Incorporating Verifying Sifting
Surface*	Networking Monitoring	Picture building	
Surface (combined)	Chancing Networking	Identifying keywords Defining a problem	Reviewing
Self-efficacy*			
Advanced*	Collecting Keyword Searching Browsing Chaining Chancing	Defining a problem Identifying Keywords	Knowing Enough Refining Sifting Verifying
Advanced (combined)	Chancing Browsing Keyword searching Collecting Chaining	Defining a problem Identifying keywords	Reviewing Incorporating Verifying Sifting Knowing enough Verifying
Intermediate*	Networking		
Intermediate (combined)	Chancing Collecting Keyword searching Browsing Chaining Networking	Defining a problem Identifying keywords	Reviewing Incorporating Verifying
Notes. * Only odds of higher than 1.5:1 are shown in this table for the replication study results. Processes in bold are those processes frequently conducted in the combined results			

Table VIII. Significant relationships between information processes and personality types

Positive relationships				
Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
	Keyword Searching Chancing Identifying keywords Knowing enough	Collecting Keyword Searching Chancing Defining a problem Reviewing Identifying keywords Knowing enough	Picture building	Chaining Knowing enough Sifting

Negative relationships				
Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness
Incorporating		Networking Picture building		

Table IX Profiles and associated information literacy, personality traits and information processes

Profile	Level of confidence with information literacy	Personality	Associated information processes
Deep Adventurer	Higher	Openness	Browsing, Chancing, Chaining, Identifying Keywords, Sifting, Incorporating, Knowing enough, Verifying
Deep Explorer	Higher	Aggreeableness	Chancing, Collecting, Keyword Searching, Exploring Breadth, Identifying Keywords, Defining a Problem, Reviewing, Knowing enough
Strategic Detector	Higher	Agreeableness	Chancing, Keyword Searching, Defining a problem, Refining, Knowing Enough
Strategic All-rounder	Higher	Conscientiousness	Chaining, Keyword Searching, Collecting, Defining a Problem, Identifying keywords, Knowing Enough, Collecting, Sifting, Verifying Reviewing
Strategic Collector	Lower	Emotional Stability	Collecting, Chancing, Identifying Sources, Identifying keywords, Picture building, Reviewing
Surface Co-ordinator	Lower	Extraversion	Networking, Monitoring, Picture building, Defining a problem, Reviewing, Incorporating

Table X. Comparing information behaviour profiles with needs of practice

Profile	Academic skills/progress	Transition to practice may require....
Deep Adventurer = High confidence with Information Literacy, Openness, Browsing, Chancing, Chaining, Identifying Keywords, Sifting, Incorporating, Knowing enough, Verifying	Good range of core information processes, with evidence of critical reflection.	Professional networking although openness to experience should help, and processes associated with information literacy should assist evidence-based practice.
Deep Explorer = High confidence with Information Literacy, Agreeableness, Chancing, Collecting, Keyword Searching, Exploring Breadth, Identifying keywords, Defining a problem, Reviewing, Knowing enough	Range of core information processes, perhaps more emphasis on critical reflection required.	Professional networking, although agreeableness indicates team working may be easy, and searching under time constraints may be eased (e.g. Defining a problem and Knowing enough)
Strategic Detector = High confidence with Information Literacy, Agreeableness, Chancing, Keyword Searching, Defining a problem, Refining, Knowing enough	Range of core information processes, perhaps more emphasis on critical reflection required,	Professional networking, although agreeableness indicates team working may be easy, and searching in practice under time constraints may benefit from Defining a problem, Refining and Knowing enough
Strategic All-rounder = High confidence with Information Literacy, Conscientiousness, Chaining, Keyword Searching, Collecting, Defining a problem, Identifying keywords, Knowing enough, Collecting, Sifting, Verifying, Reviewing	Very competent across the range of information processes, and focused in approach	Professional networking, although likely to be careful in approach to finding and verifying and reviewing evidence

Strategic Collector = Lower confidence with Information Literacy, Emotional Stability, Collecting, Chancing, Identifying Sources, Identifying keywords, Picture building, Reviewing	May be less effective in finding and using information, little evidence of critical reflection	Critical reflection on practice, although may be happy and resilient as a member of a clinical team.
Surface Co-ordinator = Lower confidence with Information Literacy, Extraversion, Networking, Collecting, Monitoring, Defining a problem, Picture building, Reviewing	May prefer asking peers for advice, perhaps with a more visual approach to learning, little evidence of critical reflection	Critical reflection and information literacy for practice, although may be outgoing and happy to co-operate with colleagues as a member of a clinical team.

